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REMARKS

Prior to the present amendment, claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 were pending in the present application. By the present amendment and response, claims 1, 4, 6, 9, 11, 12, and 17 have been amended. Thus, claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 remain in the present application. Reconsideration and allowance of pending claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 in view of the above amendments and the following remarks are requested.

Applicant has received a final Decision On Appeal dated June 30, 2008 from the Board of Patent Appeals and Interferences (hereinafter the "Board"). Applicant hereby requests that the prosecution of the present application be reopened under provisions of 37 CFR §1.198 and MPEP §1214.07, which permit the Applicant to reopen prosecution by submitting a request for continued examination (RCE) under 37 CFR §1.114. Accordingly, Applicant respectfully requests that the currently amended claim be entered in the present application. Applicant submits that pending claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 are patentably distinguishable over the art of record, and respectfully requests that claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 be examined for an early allowance in the present application.

A. Rejection of Claims 1, 2, and 4-7 under 35 USC §103(a)

The Examiner has rejected claims 1, 2, and 4-7 under 35 USC §103(a) as being unpatentable over U.S. patent number 6,858,506 to Kent Kuohua Chang (hereinafter "Chang") in view of U.S. patent application publication number 2004/0115929 A1 to Bi

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O. Lim (hereinafter "Lim"). For the reasons discussed below, Applicants respectfully submit that the present invention, as defined by amended independent claims 1 and 6, is patentably distinguishable over Chang and Lim, either singly or in combination thereof.

Amended independent claim 1 defines the present invention to include forming an ultra-uniform silicide on source/drain junctions and on a gate within a thermal budget having a temperature dependent up a silicide metal. As disclosed in the present application, although nickel silicide has many desirable characteristics, it has been found to be difficult to form robust nickel silicide. *See, e.g.,* page 7, lines 21-23 of the present application. However, as disclosed in the present application, an ultra-uniform nickel silicide can form extremely robust nickel silicide, wherein "ultra-uniform silicide" is defined as a layer of silicide having no variations in thickness greater than about 3% of the overall thickness. *See, e.g.,* page 7, lines 26-28 of the present application.

As disclosed in the present application, in an embodiment of the invention, ultra-uniform nickel silicides, such as silicides 604, 606, and 608, can be formed by depositing nickel on exposed silicon areas by using a very low power deposition process. *See, e.g.,* page 7, lines 29-31 and Figure 6 of the present application. As disclosed in the present application, a "very low power" means a power level below 500 watts direct current. *See, e.g.,* page 7, lines 31-32 of the present application. Also, as disclosed in the present application, an extra slow rate of metal deposition is preferred, which is defined to be below 7.0 Angstroms per second. *See, e.g.,* page 8, lines 1-2 of the present application. In an embodiment of the present invention, an ultra-uniform, ultra-thin silicide can be advantageously provided by using the very low power deposition process to deposit the

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silicide metal, such as nickel, at the extra slow rate of metal deposition to a thickness of not more than 50 Angstroms. *See*, e.g., page 8, lines 3-5 of the present application.

In contrast to the present invention as defined by amended independent claim 1, Chang does not disclose forming an ultra-uniform silicide on source/drain junctions and on a gate within a thermal budget having a temperature dependent up a silicide metal. Chang specifically discloses forming silicide film 234 atop gate structure 208a and heavily doped source/drain regions 218 to lower the sheet resistance at the source/drain area and the gate electrode. *See*, e.g., Figure 2G and related text of Chang. In Chang, if silicide film 234 comprises nickel silicide, the consumption of silicon in gate structure 208a and strained silicon layer 204 can be reduced. *See*, e.g., column 5, lines 2-4 of Chang. However, Chang fails to disclose forming an ultra-uniform silicide on source/drain junctions and on a gate, as specified in amended independent claim 1 and as defined in the present application. Furthermore, Chang does not mention any relationship between the uniformity of silicide film 234 and the robustness of silicide film 234 or any reason to form a silicide having a high degree of uniformity.

In contrast to the present invention as defined by amended independent claim 1, Lim does not disclose forming an ultra-uniform silicide on source/drain junctions and on a gate within a thermal budget having a temperature dependent up a silicide metal. Lim specifically discloses forming contact hole 12 in insulating layer 11 and forming a barrier metal in contact hole 12, where the barrier metal can comprise a tungsten nitride layer (e.g. tungsten nitride layer 37) and can be deposited by an atomic layer deposition (ALD) process. *See*, e.g., paragraphs [0020] and [0021] and Figures 3 through 7 of Lim. In

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Lim, tungsten layer 39 can be deposited on tungsten nitride layer 37, where tungsten nitride layer 37 and tungsten layer 39 are preferably in-situ deposited in the same reaction chamber. See, e.g., paragraph [0026] and Figure 8 of Lim.

However, Lim fails to disclose forming an ultra-uniform silicide on source/drain junctions and on a gate within a thermal budget having a temperature dependent up a silicide metal, as specified in amended independent claim 1. Thus, Lim fails to cure the aforementioned deficiencies of Chang. As such, Applicants respectfully submit that the combination of Chang and Lim suggested by the Examiner does not and cannot achieve the present invention as defined by amended independent claim 1.

For all the foregoing reasons, Applicants respectfully submit that, at the time the invention defined by amended independent claim 1 was made, the invention would not have been obvious to a person of ordinary skill in the art by Chang and Lim. Thus, amended independent claim 1 is patentably distinguishable over Chang and Lim and, as such, claims 2, 4, and 5 depending from amended independent claim 1 are, *a fortiori*, also patentably distinguishable over Chang and Lim for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Amended independent claim 6 defines the present invention to include forming ultra-uniform nickel silicide on source/drain junctions and on a gate within a thermal budget having a temperature of less than about 400 degrees centigrade, where the ultra-uniform nickel silicide is formed by using a very low power vapor deposition process. The present invention as defined by amended independent claim 6 provides similar advantages as the present invention as defined by amended independent claim 1. As

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discussed above, neither Chang nor Lim disclose forming an ultra-uniform silicide on source/drain junctions and on a gate. Thus, Applicants respectfully submit that amended independent claim 6 is patentably distinguishable over Chang and Lim for at least the reasons presented above and also for the additional limitations contained in the amended independent claim. Accordingly, claim 7 depending from amended independent claim 6 is, *a fortiori*, also patentably distinguishable over Chang and Lim.

B. Rejection of Claims 9, 11, 12, 15-17, and 20 under 35 USC §103(a)

The Examiner has rejected claims 9, 11, 12, 15-17, and 20 under 35 USC §103(a) as being unpatentable over Chang in view of Lim, and further in view of U.S. patent application publication number 2005/0035460 to Horng-Huei Tseng (hereinafter “Tseng”). As discussed above, amended independent claim 6 is patentably distinguishable over Chang and Lim. Thus claim 9 depending from amended independent claim 6 is, *a fortiori*, also patentably distinguishable over Chang and Lim, or any combination of Chang and Lim with Tseng, for at least the reasons presented above and also for additional limitations contained in the dependent claim. For the reasons discussed below, Applicants respectfully submit that the present invention, as defined by amended independent claims 11 and 17, is patentably distinguishable over Chang, Lim, and Tseng, either singly or in any combination thereof.

Amended independent claim 11 defines the present invention to include an ultra-uniform silicide on source/drain junctions and on a gate. The present invention as defined by amended independent claim 11 provides similar advantages as the present

invention as defined by amended independent claim 1. As discussed above, neither Chang nor Lim disclose an ultra-uniform silicide on source/drain junctions and on a gate, as specified in amended independent claim 11.

In contrast to the present invention as defined by amended independent claim 11, Tseng does not disclose an ultra-uniform silicide on source/drain junctions and on a gate. Tseng specifically discloses metal silicides 115 situated on gate electrode 111 and source/drain regions 113 in semiconductor substrate 100. *See, e.g.,* paragraph [0037] and Figure 2 of Tseng. In Tseng, metal silicides 115 can be titanium silicide, cobalt silicide, or nickel silicide, and preferably have a thickness between about 50 Angstroms and 350 Angstroms. *See, e.g.,* paragraph [0037] of Tseng. However, Tseng fails to disclose an ultra-uniform silicide on source/drain junctions and on a gate, as specified in amended independent claim 11.

Furthermore, Tseng does not mention any relationship between the uniformity of metal silicides 115 and the robustness of metal silicides 115 or any reason to form a metal silicide having a high degree of uniformity. Thus, Tseng fails to cure the aforementioned deficiencies of Chang and Lim. As such, Applicants respectfully submit that the combination of Chang, Lim, and Tseng suggested by the Examiner does not and cannot achieve the present invention as defined by amended independent claim 11.

For all the foregoing reasons, Applicants respectfully submit that, at the time the invention defined by amended independent claim 11 was made, the invention would not have been obvious to a person of ordinary skill in the art by Chang, Lim, and Tseng. Thus, amended independent claim 11 is patentably distinguishable over Chang, Lim, and

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Tseng and, as such, claims 12, 15, and 16 depending from amended independent claim 11 are, *a fortiori*, also patentably distinguishable over Chang, Lim, and Tseng for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Amended independent claim 17 includes similar limitations as amended independent claim 11. Thus, for similar reasons as discussed above, amended independent claim 17 is also patentably distinguishable over Chang, Lim, and Tseng. Thus, claim 20 depending from amended independent claim 17 is, *a fortiori*, also patentably distinguishable over Chang, Lim, and Tseng for at least the reasons presented above and also for the additional limitation contained in the dependent claim.

C. Rejection of Claim 10 under 35 USC §103(a)

The Examiner has rejected claim 10 under 35 USC §103(a) as being unpatentable over Chang in view of Lim, and further in view of Tseng and *Silicon Processing for the VLSI Era*, Vol. 1, by Wolf et al. (hereinafter "Wolf"). As discussed above, amended independent claim 6 is patentably distinguishable over Chang and Lim. Thus, claim 10 depending from amended independent claim 6 is, *a fortiori*, also patentably distinguishable over Chang and Lim, or any combination of Chang and Lim with Tseng and Wolf, for at least the reasons presented above and also for additional limitations contained in the dependent claim.

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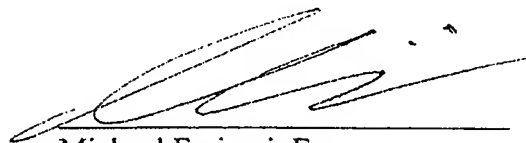
D. Rejection of Claims 14 and 19 under 35 USC §103(a)

The Examiner has rejected claims 14 and 19 under 35 USC §103(a) as being unpatentable over Chang in view of Lim and Tseng, and further in view of Wolf. As discussed above, amended independent claims 11 and 17 are patentably distinguishable over Chang, Lim, and Tseng. Thus claim 14 depending from amended independent claim 11 and claim 19 depending from amended independent claim 17 are, *a fortiori*, also patentably distinguishable over Chang, Lim, and Tseng, or any combination of Chang, Lim, and Tseng with Wolf, for at least the reasons presented above and also for additional limitations contained in each dependent claim.

E. Conclusion

For all the foregoing reasons pending claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 are patentably distinguishable over the cited art, and an early allowance of pending claims 1, 2, 4-7, 9-12, 14-17, 19, and 20 is respectfully requested.

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Respectfully Submitted,
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